SOUTHERN PACIFIC RAILROAD,
PECOS RIVER HIGH BRIDGE
(Texas and New Orleans Railroad,
Pecos River High Bridge)
(Pecos Viaduct)
Texas Historic Bridges Recording Project
Spanning Pecos River at Southern Pacific Railroad
Langtry Vicinity
Val Verde County
Texas

HAER No. TX-75

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HISTORIC AMERICAN ENGINEERING RECORD
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HISTORIC AMERICAN ENGINEERING RECORD

SOUTHERN PACIFIC RAILROAD, PECOS RIVER HIGH BRIDGE
(Texas and New Orleans Railroad, Pecos River High Bridge)
(Pecos Viaduct)

HAER No. TX-75

Location:	Spanning Pecos River at Southern Pacific Railroad, Langtry vicinity, Val Verde County, Texas. UTM: 14/272090/3294145 USGS: Pecos High Bridge, Texas, quadrangle (1979).
Date of Construction:	1943-1944.
Designer:	Modjeski and Masters (Harrisburg, Pennsylvania).
Builder:	Brown and Root (Houston, Texas), substructure; Bethlehem Steel Company (Chicago, Illinois), superstructure.
Present Owner:	Southern Pacific Rail Corporation.
Present Use:	Railroad bridge.
Significance:	The Pecos River gorge has been the location of two of the world's highest bridges: the 1892 Pecos Viaduct and the current structure, its 1944 successor. Increased traffic during World War II necessitated the replacement of this critical link on a major east-west railroad. Though built under material and labor constraints caused by the war, this 1390'-6"-long continuous steel cantilever truss' austere design is nonetheless in harmony with its remote desert setting. The Pecos River High Bridge is also significant for technical achievements, such as its 275'-high slip-formed concrete piers.
Historian:	Justin M. Spivey, October 1998.
Project Information:	This document was prepared as part of the Texas Historic Bridges Recording Project performed during the summer of 1996 by the Historic American Engineering Record (HAER). The project was co-sponsored by the Texas Department of Transportation (TxDOT).

The Pecos River High Bridge, also known as the Pecos Viaduct, spans a deep gorge about four miles upstream from the Texas-Mexico border. In his book, *Bridges: The Spans of North America,* David Plowden called the present structure built in 1943-1994 "America's last important railroad bridge."[1] His assertion that it is "visually and technically one of the most spectacular railway bridges ever built" could also apply to its predecessor, which was North America's highest bridge when completed in 1892.[2] Although the first High Bridge seems spindly and complicated when compared to the bold, simple lines of its replacement, both structures' impressive dimensions represent feats of structural engineering. The isolated location presented challenges to builders of both structures. Design of the second High Bridge, by Modjeski and Masters of Harrisburg, Pennsylvania, was further constrained by wartime labor and material shortages. The resulting structure is a technical achievement not without aesthetic merit: a striking cantilever truss and tall stepped concrete piers complement the limestone cliffs of the Pecos River gorge.

Despite its remote location (it is one of few man-made structures in the U.S. Geological Survey quadrangle map bearing its name), the High Bridge is crucial to transcontinental passenger and freight rail traffic on the Southern Pacific (SP) route from New Orleans to Los Angeles.[3] The closest railroad bridge spanning the Pecos is on the Atchison, Topeka and Santa Fe Railroad at Girvin, more than a hundred miles upstream and requiring a substantial northern detour through Coleman and San Angelo. The Pecos River High Bridge's importance is underscored by U.S. Army protection during World War II, and the War Department's prohibition of publications describing the present bridge's construction until the close of the war.[4]

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[1] David Plowden, *Bridges: The Spans of North America* (New York: W. W. Norton and Company, 1974), p. 257.

[2] T. Lindsay Baker, *Building the Lone Star State: An Illustrated Guide to Historic Sites* (College Station: Texas A&M University Press, 1986), p. 124.

[3] U.S. Department of the Interior, Geological Survey, *Pecos High Bridge Quadrangle: Texas — Val Verde County, 7.5 Minute Series* (Washington, D.C.: Government Printing Office, 1979).

[4] On Army protection, see Jimmy Banks, "Paragon of the Pecos," *Railway Progress* 6, No. 9 (November 1952): 40-53, quoted in Richard J. Cook, *The Beauty of Railroad Bridges in North America — Then and Now* (San Marino, California: Golden West Books, 1987), pp. 88-90. On War Department censorship, see editor's note in Harry J. Engel, "Pecos Gorge in Texas Spanned by New Railroad Bridge," *Engineering News-Record* 135, No. 20 (November 15, 1945): 654.

The First Pecos River High Bridge, 1891-1949

The first high-level railroad crossing of the Pecos River gorge, "one of the wonders of the railroad engineering world," opened to traffic in 1892.[5] It replaced a low bridge, an ignoble and short-lived structure built during the previous decade. To avoid the expense of a high bridge across the gorge, designers of the Galveston, Harrisburg and San Antonio Railway had decided upon a low-level crossing. The railroad, built between 1881 and 1883, included a "steep and circuitous" eleven-mile detour from the high plains of west Texas to a low iron truss bridge spanning the Pecos River near its mouth.[6] This dangerous and inefficient crossing soon became a bottleneck on the SP's Texas and New Orleans line. After nearly a decade of proposals for a more direct route, SP chief engineer Julius Kruttschnitt designed a viaduct of record-breaking height during 1890 and 1891.[7] Located about three and a half miles upstream from the low bridge, the Pecos River High Bridge was the continent's highest. It towered a dizzying 320'-10 3/4" above the mean water level. The Phoenix Bridge Company of Phoenixville, Pennsylvania, began erecting the bridge on November 3, 1891, and finished just eighty-seven days later, on February 20, 1892.[8] As originally built, the Pecos Viaduct was 2180'-0" long, and was comprised of forty-six spans including two pin-connected cantilever trusses 172'-6" long supporting an 80'-0" suspended span. The slender columns of its trestle bents contrasted visually against the solid canyon walls.

Colorful stories from the bridge's construction were collected in a 1952 *Railway Progress* article.[9] Pecos Viaduct lore stars local lawman Judge Roy Bean, who is commemorated in museums in nearby Del Rio and Langtry. According to one tale, when a collapsed span killed seven men and injured three, Judge Bean pronounced all ten dead to avoid making a second trip to the remote construction site. Chinese immigrants, who built the railroad a decade before, presumably labored on the High Bridge as well.[10] The High Bridge became the setting for suicides and stunts, including flying a plane between its piers.

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[5] Cook, p. 88.

[6] Baker, p. 124.

[7] Plowden, p. 71.

[8] The following description is taken mostly from Cook, pp. 87-88.

[9] The article is quoted at length in Cook, pp. 88-90.

[10] On immigrant labor, see "New Pecos River Bridge Has High Piers," *Railway Age* 118, No. 21 (May 26, 1945): 930.

Increasing railroad loads necessitated repairs in 1910. A new line of girders was installed and the westernmost nineteen spans were replaced by an earth embankment. Further reinforcement in 1929 attested to the bridge's inadequacy for ever-increasing railroad loads. SP deferred replacement of the outdated structure, choosing instead to continue repairs. "Fatigue cracks were discovered and repaired in some of the bracing details of the high towers, and the diagonal bracing rods of the towers were frequently adjusted to keep the towers plumb. Because of this situation, annual inspections were made . . . ," according to Harry J. Engel of Modjeski and Masters.[11] This remark about the old Pecos Viaduct occurs in an article about the construction of a new bridge, which might indicate some disdain for the railroad's policy.

America's entrance into World War II, however, impelled replacement of the Pecos River High Bridge. SP, saddled with increasing freight traffic on its Texas and New Orleans line due to the war effort, began studies for a new bridge in late 1942.[12] A new concrete and steel crossing was completed two years later. Even after the *Sunset Limited* began official traffic over the new structure on December 21, 1944, the original High Bridge remained in place until 1949. When no longer needed as a standby, the first Pecos River bridge's individual spans were sold off, to be used as shorter bridges elsewhere.[13]

Modjeski and Masters

As SP pondered construction of the first Pecos River High Bridge, Polish immigrant Ralph Modjeski began his civil engineering career. More than half a century later, the engineering firm he established would design a second high-level bridge. Modjeski first took a job inspecting railroad bridges in the late 1880s, beginning a lifetime of work with American railroads. He worked his way up to building Mississippi River crossings with engineering greats George S. Morison and Alfred Noble, and advising on the Quebec Bridge in 1908.[14] Modjeski then established his own engineering firm in Pennsylvania, and in collaboration with Frank M. Masters and Clement E. Chase, designed prominent Philadelphia bridges such as the Delaware River (Benjamin Franklin) suspension bridge (1926), Tacony-Palmyra Bridge (1929), and Henry

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[11] Harry J. Engel,"New Cantilever Carries Southern Pacific Over Pecos River," *Civil Engineering* 15, No. 10 (October 1945): 450.

[12] Engel, "Pecos Gorge in Texas," p. 84.

[13] Baker, p. 126. The government of Guatemala had planned to purchase the entire structure, but this did not occur for some reason.

[14] Thomas Duszak, "A Music Student Bridges the World," *Pennsylvania Heritage,* Winter 1986.

Avenue Bridge (1933, HAER No. PA-464). In 1935, Modjeski and partners witnessed the completion of their Huey P. Long Bridge, which carried railroad and vehicular traffic for 4.35 miles across the Mississippi north of New Orleans. It was one of the world's longest and most expensive bridges at the time.[15]

More than seven hundred miles west of the Huey Long Bridge, transcontinental Amtrak and SP trains cross the Pecos River on another of Modjeski and Masters' grand accomplishments. The Huey Long and Pecos River bridges, "two most outstanding examples of bridge engineering," are connected by more than superlatives.[16] Though designed after Modjeski's death in 1940, the Pecos River High Bridge continues the firm's reputation for designing railroad structures of monumental size, if not appearance.

Building a Replacement, 1942-1944

The second Pecos River High Bridge's structural form allowed it to support greater loads than its predecessor while using a comparable amount of metal. In its original configuration, the spindly 1892 Pecos Viaduct contained 1,820 tons of iron, to which subsequent retrofits added weight.[17] Despite reinforcements, the structure could only carry limited loads at twelve miles an hour. The second High Bridge, whose steel work weighs 2,650 tons, carries modern loads across the gorge in a much different way than its predecessor. Material shortages during World War II partly dictated the new bridge's shape. According to Engel, "the least amount of steelwork, . . . the greatest economy under wartime conditions, and the most satisfactory structure was obtained with the continuous cantilever type."[18] Reinforced concrete piers further reduced the quantity of steel in the structure.

Designers of the replacement bridge calculated vertical loads imposed by heavier trains, forces exerted by wind (acting both perpendicular to and along the structure), and longitudinal forces due to acceleration and braking of trains. While the 1892 structure was probably not designed to resist earthquake forces, its replacement took into account a possible ground acceleration of $0.1g$.[19] (Because structural continuity over supports allows a span to utilize the bending resistance of adjacent spans, a continuous truss does not need to be as deep as a simply

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[15] Cook, p. 82.

[16] Plowden, p. 257.

[17] Baker, p. 126.

[18] Engel, "Pecos Gorge in Texas," p. 86.

[19] Ibid. g is the acceleration due to Earth's gravity.

supported one carrying the same loads.) In addition, continuous structures may be erected using a cantilever method, whereby spans are constructed from each abutment toward the center while using the already completed portion as a working platform and counterbalance. Except on the outermost spans, cantilever erection required no falsework, which would have been impractical in the deep gorge. Because of the changing structural configuration during cantilever erection, however, several intermediate states had to be considered in addition to the completed structure.

The new structure's piers, built of reinforced concrete (a material unknown to engineers in the 1890s), allowed an additional savings of steel. Though lateral and longitudinal forces applied bending stresses to the piers, concrete (a material high in compressive strength) was suitable for carrying the overwhelming compressive load in the piers. The tallest piers, C and D, support the truss with rollers that restrain vertical movement while allowing longitudinal movement — therefore minimizing bending in the longitudinal plane. Even with the rollers, piers C and D still carry transverse forces, explaining their greater dimension perpendicular to the span. Because they support anchor spans, piers A and F were designed for uplift (tensile) forces.

While a pier ideally would taper uniformly from top to bottom, it would require a great deal of form work, especially over the 275'-4 1/2" of the Pecos River bridge's tallest pier (pier C). Modjeski and Masters instead chose slip-forming, a method whereby a short form is moved upward for another concrete pour when the previous pour reaches sufficient strength. Slip-forming required the Pecos River bridge's piers to have "vertical sides, narrowed in occasional steps."[20] The piers are hollow octagonal shells, to reduce the amount of concrete and speed curing. In the sloped transition piece at the junction between each shell and the narrower one above, steel reinforcement is like that found in a reinforced concrete dome.

The piers' shape was not dictated by practical considerations alone. Among a list of engineering design parameters in an *Engineering News-Record* article about the bridge, Engel noted that "octagonal pier ends were chosen to conform architecturally to the rugged character of the rock cliffs of the site."[21] Though war-imposed restrictions demanded a highly efficient structure, its appearance was evidently still important to the designers. The steel truss, a single bold line atop the solid piers, contrasts with the busy trestle bents of the previous structure and seems, perhaps intentionally, more harmonious with the grand scale of the gorge.

The Pecos River High Bridge's seven spans are arranged symmetrically about its center line. An 80'-0"-long simply supported girder span connects the abutment to pier A. Rollers atop pier A support the tip of an 160'-6"-long anchor arm, which is pinned to the top of pier B. Span B-C is a 267'-6" continuous side span, which rests on rollers at pier C. The center span C-D is 374'-6" long, including a 214'-0" suspended section. The two trusses, 38'-0" deep between chord

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[20] Ibid., p. 87.

[21] Ibid.

centers at mid-span, are spaced 19'-0" apart. Rolled stringers span between panel points, typically 26'-9" on center, to support the single track. According to Engel, the top lateral bracing was detailed to help resist longitudinal forces, thus achieving greater structural efficiency.[22]

To ensure the second High Bridge's longevity, designers paid close attention to protecting the timber ties from fire, and the steel trusses from salt water and other corrosives carried by trains. Wrought-iron sheeting covers the entire deck, except for a 2" x 6" timber running down the center which serves as an electrical insulator between the two rails. The bridge also carries side walkways with handrails, an inspection walk beneath the track, and a water pipe (for extinguishing fires) atop the north truss.

Design could account for war-related material and labor shortages, but construction could not. Nearly six months passed between the initial application for materials and War Production Board (WPB) approval.[23] During construction, WPB officials delayed steel fabrication several times.[24] When materials weren't in short supply, labor was. Mexicans and Native Americans traveled to Texas in order to maintain the pace of construction. Workers were recruited as far away as Canada — according to one article, "the contractor had to import Caughnawaga Indians from Montreal to finish the riveting."[25] Communication between workers speaking different languages thus became an additional challenge during construction. Nonetheless, the new Pecos River High Bridge was completed in less than a year and a half.

Conclusion

Transcontinental railroad traffic has crossed the lower Pecos River gorge on tall bridges for more than a hundred years. Although the two structures that have occupied the site were both engineering marvels, whose construction was challenged by the remote location and accomplished with immigrant labor, they differ in appearance. A spindly metal viaduct underwent numerous modifications to accommodate changes in railroad technology during the first half-century. By the time America's involvement in World War II necessitated its replacement, advances in structural engineering and the development of reinforced concrete resulted in an entirely different structural form. The second Pecos River High Bridge endures as a critical link in the SP system, still carrying the railroad loads for which it was designed. It is

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[22] Ibid.

[23] Ibid., p. 84.

[24] "New Pecos River Bridge," p. 932.

[25] Ibid.

among the greatest examples, not only of Modjeski and Masters' railroad work, but of bridge engineering in general.

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APPENDIX: Suggestions for Further Research

Due to limitations in the scope of the Texas Historic Bridges Recording Project, several questions which arose during the research and writing of this report remain unanswered. It is suggested that scholars interested in this bridge consider pursuing the following:

1. Did Southern Pacific decide on its own to replace the Pecos River High Bridge, or did the U.S. government pressure the railroad? If so, was federal funding involved? A detailed search of SP archives in San Francisco, or War Production Board records (record group 179, National Archives, Washington, D.C.) might clarify this issue.

2. Which entities purchased spans from the first High Bridge? Are any of these secondhand bridges still extant?

3. Who at Modjeski and Masters actually designed the second High Bridge? Although Harry J. Engel, an employee of that firm, wrote articles about the bridge for engineering periodicals, he is not specifically credited as the design engineer.

YEGUA CREEK BRIDGE
(Tommelson Creek Bridge)
Texas Historic Bridges Recording Project
Spanning Tommelson Creek at Cedar Hill Road (County Route 241)
(Moved from Yegua Creek at Brenham-Caldwell Road
[State Route 36], Sommerville vicinity, Burleson County)
(Moved to Higgins Creek in Henderson Park,
Brenham, Washington County)
Brenham Vicinity
Washington County
Texas

HAER No. TX-53

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HISTORIC AMERICAN ENGINEERING RECORD

YEGUA CREEK BRIDGE
(Tommelson Creek Bridge)

HAER No. TX-53

Location:	Spanning Tommelson Creek at Cedar Hill Road (County Route 241), Brenham vicinity, Washington County, Texas. (Moved from Yegua Creek at Brenham-Caldwell Road [State Route 36], Somerville vicinity, Burleson County, Texas.) (Moved to Higgins Creek in Henderson Park, Brenham, Washington County, Texas.) UTM: 14/748130/3348420 USGS: Brenham, Texas quadrangle (1989).
Date of Construction:	1890-1891.
Designer:	Missouri Valley Bridge and Iron Works, Leavenworth, Kansas.
Builder:	Missouri Valley Bridge and Iron Works, Leavenworth, Kansas.
Present Owner:	City of Brenham.
Present Use:	Pedestrian bridge.
Significance:	The Yegua Creek Bridge is a rare surviving example of the work of Missouri Valley Bridge and Iron Works in Texas, and the last remaining Pratt through truss in Washington County.
Historian:	Robert W. Jackson, August 1997.
Project Information:	This document was prepared as a part of the Texas Historic Bridges Recording Project performed during the summer of 1996 by the Historic American Engineering Record (HAER). The project was sponsored by the Texas Department of Transportation (TxDOT).

Introduction

The Yegua Creek Bridge (also known as the Tommelson Creek Bridge), a 78'-9"-long, pin-connected Pratt through truss erected by the Missouri Valley Bridge and Iron Works during the winter of 1890-1891, served the residents of Burleson and Washington counties for more than one hundred years as a roadway bridge at two different locations. It was relocated in 1994 for use as a pedestrian bridge across Higgins Creek in Henderson Park, Brenham, Texas. It survives in its present location as both a extant example of the work of a nationally prominent bridge-building firm, and as an increasingly rare example of the Pratt through metal truss, a bridge type once ubiquitous throughout the State of Texas. The history of this bridge may be traced back to an important period in the growth of Burleson and Washington counties; a time when both the economy and the transportation infrastructure of the area was in transition.

Yegua Creek Bridge

Yegua Creek forms the southeastern boundary of Burleson County and the northern boundary of Washington County. In the latter part of the nineteenth century, a road existed between Caldwell, the Burleson County seat, and Brenham, the Washington County seat. The road crossed Yegua Creek at a point known as Lang Bridge Crossing, or simply, Lang Crossing. In 1880, the Gulf, Colorado, and Santa Fe (GC&SF) Railway extended the Brenham-Cameron branch of its main line from Brenham to Caldwell on a line roughly parallel to the Brenham-Caldwell road, and this extension led to the establishment of Somerville a few years thereafter as a station on this line. In 1883, the year that the first survey for the town was filed for record, a twenty-eight-mile-long subsidiary line was established between Somerville and Navasota, thus providing the GC&SF with access to the commercially exploitable "piney woods" of East Texas. Located approximately seventeen miles southeast of Caldwell, thirteen miles northwest of Brenham, and one and one-half miles north of Yegua Creek, Somerville became the home of the only large industrial installation in Burleson County in the mid-1890s when a group of Chicago capitalists succeeded in establishing the Texas Tie and Lumber Preserving Company at a site on the east side of the main railroad line. However, the need for improvements to the Brenham-Caldwell road, including construction of a metal truss bridge over Yegua Creek, was evident long before construction of the tie and lumber plant due to the railroad-facilitated economic growth of Brenham, Somerville, and Caldwell.[1]

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[1] Burleson County Historical Society, *Astride the Old San Antonio Road: A History of Burleson County, Texas* (Dallas, Texas: Taylor Publishing Company, 1980), pp. 38-40, 68, 69; Charles F. Schmidt, *History of Washington County* (San Antonio, Texas: Naylor Company, 1949), pp. 23, 24; Wilfred O. Dietrich, *The Blazing Story of Washington County* (Brenham, Texas: Banner Press, 1950; reprinted Wichita Falls, Texas: Nortex, 1973), pp. 1, 2; Ron Tyler, ed., *The New Handbook of Texas,* vol. I (Austin: Texas State Historical Association, 1996), pp.

At their regular meeting early in November, 1890, the Commissioners' Court of Burleson County, Texas, noted the following:

> Whereas a good and Substantial Bridge is greatly needed across the Yegua at, or near, what is known as the "Lang Bridge" Crossing of said Stream, on the Caldwell and Brenham Road; and whereas the Commissioner's Court of Washington County together with the citizens of Brenham have manifested a willingness and desire to contribute largely towards construction of such bridge . . . , be it ordered that the sum of Five Hundred Dollars be and the same is hereby appropriated out of the Road and Bridge Fund of this county, to be applied toward the payment of said bridge.[2]

The funds thus appropriated were to be drawn in favor of the contractor of the bridge upon completion of the structure, provided that a report be filed with the clerk of the court showing that the bridge was worth "at least One Thousand Dollars." The name attached to the Yegua Creek crossing indicates that some sort of bridge already existed at that point on the Brenham-Caldwell road. Although the specific type of bridge in use at Lang Crossing prior to erection of a metal truss bridge is unknown, it was certainly a wood bridge of limited capacity.

The Commissioner's Court of Washington County followed the action of the Burleson County Commissioners by voting on November 13 to receive bids for construction of the "iron" bridge on November 26, with "each bidder to furnish his own plans & specifications. . . ."[3] On

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ed., *The New Handbook of Texas,* vol. 1 (Austin: Texas State Historical Association, 1996), pp. 840-45; ibid., vol. 6, pp. 834-36.

[2] Burleson County, Texas, *Commissioners' Court Minutes,* vol. F (Burleson County Courthouse, Caldwell, Texas), p. 6 (11 November 1890).

[3] Washington County, Texas, *Commissioners' Court Minutes,* vol. B (Washington County Courthouse, Brenham, Texas), p. 395. Although the minutes of the Washington County Commissioners' Court, as well as accounts published in the *Brenham Banner,* indicate that an iron bridge was erected over Yegua Creek, it was not uncommon during the period when bridge-building companies were beginning to use steel instead of iron for short-span bridges, which began roughly in the 1880s, that county of officials and the general public routinely used the term "iron bridge" as a generic term for "metal bridge". Because it is extremely difficult to differentiate an iron span from a steel span without destructive testing of the metal, it is difficult to definitively determine what type of metal was used in fabrication of the subject bridge. However, the contract card maintained by the bridge company indicates that an iron bridge was erected at this site. A copy of this card, obtained from the files of the Kansas State Historical Society, is located in the Missouri Valley Bridge and Iron Works vertical file, Texas Department

November 27, the Brenham Banner reported that numerous bids for the building of this bridge were received, and that the bid of Missouri Valley Bridge and Iron Works was approved. The bridge was to be "an iron bridge and to be completed by April 1st, 1891, [and] to cost $3,200."[4]

Some confusion apparently arose soon thereafter regarding the financial contribution of the Burleson County Commissioners' Court, because on December 11, 1890, the commissioners felt the need to clarify their action of the previous month regarding their allotment of five hundred dollars towards construction of the bridge. According to minutes of the meeting held on December 11,

> In order to explain what was meant by said appropriation it is hereby ordered that said appropriation was made for the purpose of improving the road leading from Bridge into Burleson County and that said appropriation is made on condition that the private subscription mentioned in said order shall amount to a sufficient sum to put said road in good condition to accommodate the public travel.[5]

Whatever may have been the financial contribution of Burleson County, the bridge was successfully completed the following spring. Apparently, however, the bridge company didn't quite complete the bridge by April 1, as originally stipulated by the Washington County Commissioners' Court, because the *Brenham Banner* reported on April 16, 1891:

> The new iron bridge at the Lang Crossing, on the Yegua thirteen miles north of here, has just been completed by the Missouri Valley Bridge and Iron Works, under supervision of Mr. P. Sullivan. It is one of the best structures ever erected in the county, is 80 feet long not including the approaches which have not been built yet, and is of the Pratt truss patent. The authorities will examine it in a few days when it will be formerly turned over to the county.[6]

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[4] *Brenham Banner,* 27 November, 1890. The contract card maintained by the bridge company indicates that the contract was for $2,790. The discrepancy between company records, commissioners' court records, and newspaper accounts of the cost of the bridge may be linked to the fact that Missouri Valley Bridge and Iron was involved in a pooling arrangement with other bridge companies operating in Texas at this time. Under terms of the arrangement, the gross amount paid by a county for a bridge did not reflect the total revenue for the contractor since the wining bidder often had to pay losing bidders a portion of the contract award. See Eli Woodruff Imberman, "The Formative Years of Chicago Bridge & Iron Company" (Ph.D. diss., University of Chicago, 1973), pp. 272-73.

[5] Burleson County, *Commissioners' Court Minutes,* vol. F, p. 24 (11 December 1890).

[6] *Brenham Banner,* 16 April 1891.

It wasn't until May 13, 1891, that the commissioners of the two counties met in joint session to make arrangements for the construction of approaches to the new bridge.[7] But with erection of the metal span completed, the Washington County Commissioners' Court voted on the same day to pay the bridge company $2,565.[8]

Missouri Valley Bridge and Iron Works

The subject bridge was just one of many erected in Texas by the Missouri Valley Bridge and Iron Works, which was first organized as the Missouri Valley Bridge Company in 1874. Originally a partnership of E. I. Farnsworth and a man named Reeves, the company was taken over in 1876 by the Insley and Shire Bank. A. J. Tullock, then a resident of Rockford, Illinois, was employed as chief engineer and manager until he purchased a share of the business in 1880, at which time the company name was changed to Missouri Valley Bridge and Iron Works. In 1886, a branch office was opened in Dallas, Texas, with L. S. Leversedge as general Southern agent. In 1888, Tullock bought out his partners and continued to operate the business as a sole proprietorship until his death in 1904, at which time the business was incorporated by some past employees of Tullock and renamed the Missouri Valley Bridge and Iron Company. Under this name the company continued in operation until 1946, when it was acquired by Missouri Valley Steel, Inc.[9]

At the time the subject bridge was erected, the company was mainly engaged in providing bridges for railroads in the West, South, and Southwest. However, as was often the case with bridge companies in the late nineteenth century, Missouri Valley Bridge and Iron also fabricated turn-tables and roof trusses. It was one of the largest and most prolific bridge-building companies of its age, and it developed considerable expertise in construction of difficult subaqueous foundations, such as those for bridges across the Mississippi and Missouri Rivers.

Description

The subject bridge is a pin-connected Pratt through truss, a type of span erected in the thousands across streams, creeks and rivers throughout the United States during the late nineteenth and early twentieth centuries. The only truss form to have been executed in wood, iron and steel, the Pratt design was first patented by Thomas Pratt and his father, Caleb, on April

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[7] Ibid., 14 May 1891.

[8] Washington County, *Commissioners' Court Minutes,* vol. B, p. 424 (13 May 1891).

[9] *Leavenworth Times,* 18 March 1982; Victor C. Darnell, *Directory of American Bridge-Building Companies 1840-1900,* Occasional Publication No. 4 (Washington, D.C.: Society For Industrial Archeology, 1984), pp. 17, 18.

14, 1844. In profile the Pratt truss looks much like the Howe truss, a form much favored by the railroads for wood bridges. In function, however, the Pratt is the exact opposite of the Howe truss because its vertical members (except for the hip verticals) act in compression and its diagonals act in tension. Because it utilized a greater amount of iron than the Howe truss, and thus was more expensive to construct, the Pratt did not come into wide use until iron began to replace wood as the preferred structural material for railroad bridges. The Howe truss form was simply not adaptable for use in an all-iron bridge, and thus fell out of favor after the end of the Civil War.[10]

The subject bridge is 78'-9" long and provided a clear roadway width of 11'-9". It is composed of five panels of 15'-9" each, and has a height of 16'-0". The inclined end posts, hip verticals, and main top chord members are composed of two 1/8"-thick channels riveted to by a 1/4"-thick top plate and 1/4" x 1 1/2" lacing beneath. Rods form the top and bottom lateral bracing, single square bars with turnbuckles form the crossed diagonals of the middle panel, and double rectangular bars form the diagonals of the flanking panels. The portal bracing is composed of 1"-wide lattice, riveted to the portal strut and inclined end posts with a gap in the center. The upper lateral struts of the top chord are composed of two angles riveted together. The floor beams are I-beams, and the stringers are made of wood. Double-looped lower chord eyebars are connected by pins and secured by hex nuts to the vertical members, which are bolted to hangers at the bottom of the verticals.

A builder's plate is attached to one portal strut, which reads: "BUILT 1890 BY MO. VALLEY BRIDGE & IRON WORKS, A. J. TULLOCK PROPRIETOR, LEAVENWORTH, KANSAS." Other identifying information may be found on the inclined end posts and struts, which are stamped "CARNEGIE," indicating that the metal was rolled by either the Carnegie-Kloman Company of Pittsburgh, Pennsylvania, or by Carnegie Steel Corporation of Pittsburgh. Two metal pipe rails, which may or may not have been part of the original structure, are U-bolted to channels rising part way up, and attached to, the vertical members.

The most significant aspect of the subject bridge, other than the very real possibility that it is an iron, rather than a steel bridge, is the fact that it is pin-connected. Long after British bridge builders began to use riveted connections, American bridge companies continued to rely on pin connections due to the speed with which a pin-connected bridge could be erected. Although certain portions of the bridge could be riveted together in the shop and then pin-connected on site, it wasn't until the development of reliable field-riveting equipment in the twentieth century that American bridge builders were able to abandon pin connections altogether.

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[10] David Plowden, *Bridges: The Spans of North America* (New York: W. W. Norton and Company, 1974), pp. 40, 65.

About the time the subject bridge was erected, the pin connection methodology had reached its practical limits, but the portable pneumatic riveter was not yet available.[11]

Relocations

The bridge served the residents of Washington and Burleson County well at its original location until about 1926, at which time increased traffic on the old Brenham-Caldwell Road, long since dedicated as State Route 36, required that the Pratt truss be replaced by a two-lane bridge. The subject bridge was then moved and re-erected over Tommelson Creek on Cedar Hill Road (County Route 241), a minor two-lane unpaved road providing public access to farms in a predominately agricultural area. For many years the bridge provided a safe, albeit somewhat narrow, crossing of Tommelson Creek for school buses, farm equipment, and personal vehicles accessing rural homes until deterioration of the structural members and complaints from area farmers, who found the bridge too narrow for modern agricultural equipment, forced its replacement in 1994.[12]

In an attempt to preserve the historical integrity of the Tommelson Creek Bridge, the Texas Department of Transportation sought a new site for the span that would allow for re-erection in its original condition; i.e., without removing or altering any of the original structural members. Although the City of Brenham initially refused the bridge due to concerns over liability, after several attempts to relocate the structure to other locations proved unsuccessful the city reconsidered its earlier position and agreed to accept the bridge for use by pedestrians in a public park. A crew from Yoakum House Movers lifted the truss off of its foundations in November 1994, placed it on an beam trailer, and parked it in a nearby field over the winter. On April 10, 1995, the bridge was moved approximately eight miles to its new home in Brenham in about five hours.[13]

Conclusion

Although a common span type at the time it was originally erected, the subject bridge is now a rare artifact of late nineteenth century bridge technology. As an example of the once

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[11] David Weitzman, *Traces of the Past: A Field Guide to Industrial Archeology* (New York: Charles Scribner's Sons, 1980), pp. 79, 80.

[12] See "Environmental Assessment, Tommelson Creek, County Road 241, Washington County," 25 June 1993 (Tommelson Creek Bridge vertical file, Texas Department of Transportation, Environmental Affairs Division, Austin, Texas); *Brenham Banner-Press,* 18, 29 November 1994.

[13] *Brenham Banner-Press,* 18, 29 November 1994; 11, 13 April 1995.

commonplace work of the very prolific Missouri Valley Bridge and Iron Works, it is also a physical manifestation of the products and business practices of a bygone age. As such, it functions in its present location across Higgins Creek in Brenham not only as a connection between two parts of Henderson Park, but also as a connection to the state's, and the nation's, industrial past.

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APPENDIX: Sketch Plan and Elevation, Yegua Creek Bridge